valid pixel data S included in the portion of the valid image data to a corresponding location on a memory MEM. The AP 100 may transmit, to a DDI 300, valid pixel data UPDT(S) to be updated (hereinafter referred to as 'update pixel data UPDT(S)') and location information of a pixel to be updated (update location information UP).

[0156] The display driver IC 300 may store the valid pixel data UPDT(S) in a corresponding storage region of a GRAM, based on the update location information UP. In at least one example embodiment, the DDI 300 may write the update pixel data UPDT(S) to a storage region of the GRAM corresponding to the location of a pixel to be updated, based on mapping data mapping address information of the GRAM to location information of a valid display region of the display panel and the received update location information UP.

[0157] The display driver IC 300 may restore the valid image data VIDT by unpacking a plurality of pieces of pixel data output from the GRAM, and display an image on the valid display region of the display panel based on the valid image data VIDT. In this case, only some of valid pixel data included in the GRAM is updated, and thus, a portion of the image displayed on the valid display region may be updated.

[0158] FIG. 14A illustrates example pixels to be partially updated in a valid display region. FIG. 14B illustrates location information of pixels to be updated.

[0159] When valid pixels U1, U2, and U3 illustrated in FIG. 14A are updated to new image signals during a partial update operation, a system processor (100 of FIG. 1) may transmit update location information UP illustrated in FIG. 14B to a display driver IC (300 of FIG. 1).

[0160] Referring to FIG. 14B, the update location information UP may include information regarding vertical or horizontal lines UL to be updated, offsets, and pixel lengths. The offsets represent starting positions of valid pixels to be updated in the horizontal or vertical lines UL to be updated. The pixel lengths represent the numbers of pixels updated continuously starting from the starting positions.

[0161] For example, as illustrated in FIG. 14A, when the valid pixel U1 corresponding to a sixth column C5 of a second row R1 and the valid pixels U2 and U3 corresponding to a fifth column C5 and a seventh column C6 of a third row R2 are updated, the update location information UP may include first location information UP1 and second location information UP2 illustrated in FIG. 14B. The first location information UP1 may represent that one pixel is updated starting from a fifth pixel arranged in the second row R1. The second location information UP may represent that two pixels are updated starting from a fifth pixel arranged in the third row R2.

[0162] FIG. 15 is a signal flow diagram illustrating a method of operating a display system according to an example embodiment. FIG. 15 illustrates a method of operating a system processor AP and a display driver IC DDI during an example of normal operation of a display system.

[0163] Referring to FIG. 15, during an initialization section (or interval or period), the display driver IC DDI may transmit information regarding a valid display region of a display panel (e.g., screen information SINFO) to the system processor AP (operation S310). The valid display region may have a non-rectangular shape. The screen information SINFO may include a starting point of a valid display region and the number of pixels arranged continuously in each of horizontal or vertical lines of the display panel. The display

driver IC DDI may be initialized during the initialization section, e.g., a stabilization section (or interval or period) after power is supplied to the display system 1000 of FIG. 1 including the display driver IC 300 and the system processor 100 or a stabilization section after the display system 1000 is reset. In this case, the display driver IC DDI may transmit the screen information SINFO to the system processor AP.

[0164] The system processor AP may generate valid image data corresponding to the valid display region (operation S320). In at least one example embodiment, the system processor AP may generate the valid image data based on the screen information SINFO. In another example embodiment, the system processor AP may generate image data corresponding to a rectangular region including a valid display region. The image data may include valid image data, and invalid image data that is not actually seen.

[0165] The system processor AP may pack and write valid pixel data included in the valid image data to a memory (e.g., the memory 130 of FIG. 3) (operation S330). In at least one example embodiment, the system processor AP may pack and write a plurality of pieces of valid pixel data constituting the valid image data to the memory. In another example embodiment, the system processor AP may select valid pixel data from among image data corresponding to a rectangular region and pack and write the valid pixel data to the memory, based on the screen information SINFO.

[0166] The system processor AP may read a plurality of pieces of valid pixel data from the memory and transmit the plurality of pieces of valid pixel data to the display driver IC DDI (operation S340).

[0167] The display driver IC DDI may restore the valid image data by unpacking the plurality of pieces of received valid pixel data (operation S350). In other words, for example, the display driver IC DDI may rearrange the plurality of pieces of valid pixel data to correspond to the valid display region. The display driver IC DDI may sequentially store the plurality of pieces of received valid pixel data in a graphics memory. Thereafter, in a display section, the display driver IC DDI may read the plurality of pieces of valid pixel data from the graphics memory and rearrange the plurality of pieces of read valid pixel data to correspond to the valid display region.

[0168] The display driver IC DDI may drive the display panel based on the valid image data (operation S360). The valid image data includes valid pixel data regarding pixels included in the valid display region. Thus, the display driver IC DDI may provide image signals to the valid display region.

[0169] FIG. 16 is a signal flow diagram illustrating a method of operating a display system according to an example embodiment. FIG. 16 illustrates a method of operating a system processor AP and a display driver IC DDI during a display partial update operation of the display system. The method of FIG. 16 may be performed after the method of operating a display system illustrated in FIG. 15.

[0170] Referring to FIG. 16, the system processor AP may generate a portion of valid image data corresponding to a region of a valid display region to be updated based on screen information SINFO (operation S420).

[0171] The system processor AP may store valid pixel data constituting the portion of the valid image data (e.g., update pixel data) in a corresponding storage region of a memory (operation S430). Then, the system processor AP may trans-